AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

Claims 1-24 (canceled).

25. (original): A hydrogen gas sensor comprising:

a proton-conductive layer formed of a polymer electrolyte;

first and second electrodes disposed on opposite surfaces, respectively, of the proton-conductive layer so that the first electrode and the second electrode sandwich the proton-conductive layer;

a diffusion-rate limiting portion disposed between the first electrode and an atmosphere of a gas under measurement containing hydrogen, the diffusion-rate limiting portion comprises a dense body having a through-hole having an opening diameter of 1 μm or higher; and

a circuit for applying a voltage between the first and second electrodes such that hydrogen introduced from the atmosphere via the diffusion-rate limiting portion undergoes dissociation, decomposition, or reaction to produce protons on the first electrode, and for determining the hydrogen concentration of the gas under measurement based on a saturation current which flows as a result of conduction of protons from the first electrode to the second electrode via the proton-conductive layer, and

said sensor having a proton-conducting rate from the first electrode to the second electrode that is greater than a rate at which protons derived from hydrogen are introduced onto the first electrode via the diffusion-rate limiting portion.

26. (original): The hydrogen gas sensor as claimed in claim 25, wherein the opening diameter of the through-hole is 30 μm or higher.

27. (original): A hydrogen gas sensor comprising:

a proton-conductive layer formed of a polymer electrolyte;

first and second electrodes disposed on opposite surfaces, respectively, of the proton-conductive layer so that the first electrode and the second electrode sandwich the proton-conductive layer;

a reference electrode formed on the surface of the proton-conductive layer on which the second electrode is formed;

a diffusion-rate limiting portion disposed between the first electrode and an atmosphere of a gas under measurement containing hydrogen, the diffusion-rate limiting portion comprises a dense body having a through-hole having an opening diameter of 1 μm or higher; and

a circuit for applying a voltage between the first and second electrodes such that a constant voltage develops between the first electrode and the reference electrode, and such that hydrogen gas introduced from the atmosphere via the diffusion-rate limiting portion undergoes dissociation, decomposition, or reaction to produce protons on the first or second electrode, and for detecting the hydrogen concentration of the gas under measurement based on a saturation current which flows as a result of conduction of protons via the proton-conductive layer, and

said sensor having a proton-conducting rate from the first electrode to the second electrode that is greater than a rate at which protons derived from hydrogen are introduced onto the first electrode via the diffusion-rate limiting portion.

28. (original): The hydrogen gas sensor as claimed in claim 27, wherein the opening diameter of the through-hole is 30 μm or higher.

29. (new): A hydrogen gas sensor comprising:

a proton-conductive layer formed of a polymer electrolyte;

first and second electrodes provided in contact with the proton-conductive layer;

a diffusion-rate limiting portion disposed between the first electrode and an atmosphere of a gas under measurement containing hydrogen; and

a circuit for applying a voltage between the first and second electrodes such that hydrogen introduced from the atmosphere via the diffusion-rate limiting portion undergoes dissociation, decomposition, or reaction to produce protons on the first electrode, and for determining the hydrogen concentration of the gas under measurement based on a saturation current which flows as a result of conduction of protons from the first electrode to the second electrode via the proton-conductive layer;

said sensor having a proton-conducting rate from the first electrode to the second electrode that is greater than a rate at which protons derived from hydrogen are introduced onto the first electrode via the diffusion-rate limiting portion, and

wherein the gas-diffusion resistance of the diffusion-rate limiting portion is set such that current (a) > current (b):

current (a) is a current flowing between the first and second electrodes upon application of a voltage of 50 mV or higher between the first and second electrodes in a state in which the gas-diffusion resistance of the diffusion-rate limiting portion is 0.9 mA/mm^2 or more with current conversion at H_2 = 40% and the measurement gas has a H_2O concentration of 10% or less at 80°C or a CO concentration of 1,000 ppm or greater; and

current (b) is a saturation current flowing between the first and second electrodes in a state in which the gas-diffusion resistance of the diffusion-rate limiting portion is less than 0.9 mA/mm^2 with current conversion at H_2 = 40% and the measurement gas has a H_2O concentration of 15% or greater at 80°C or a CO concentration of 800 ppm or less.

30. (new): A hydrogen gas sensor comprising:

a proton-conductive layer formed of a polymer electrolyte;

first and second electrodes and a reference electrode provided in contact with the proton-conductive layer;

a diffusion-rate limiting portion disposed between the first electrode and an atmosphere of a gas under measurement containing hydrogen; and

a circuit for applying a voltage between the first and second electrodes such that a constant voltage develops between the first electrode and the reference electrode, and such that hydrogen gas introduced from the atmosphere via the diffusion-rate limiting portion undergoes dissociation, decomposition, or reaction to produce portions on the first or second electrode, and for detecting the hydrogen concentration of the gas under measurement based on a saturation current which flows as a result of conduction of protons via the proton-conductive layer; wherein

said sensor having a proton conducting rate from the first electrode to the second electrode that is greater than a rate at which protons derived from hydrogen are introduced onto the first electrode via the diffusion-rate limiting portion, and

wherein the gas-diffusion resistance of the diffusion-rate limiting portion is set such that current (a) > current (b):

current (a) is a current flowing between the first and second electrodes upon application of a voltage of 50 mV or higher between the first and second electrodes in a state in which the gas-diffusion resistance of the diffusion-rate limiting portion is 0.9 mA/mm^2 or more with current conversion at H_2 = 40% and the measurement gas has a H_2O concentration of 10% or less at 80°C or a CO concentration of 1,000 ppm or greater;

current (b) is a saturation current flowing between the first and second electrodes in a state in which the gas-diffusion resistance of the diffusion-rate limiting portion is less than 0.9 mA/mm^2 with current conversion at H_2 = 40% and the measurement gas has a H_2O concentration of 15% or greater at 80°C or a CO concentration of 800 ppm or less.